

EXOPLANETS

Atmospheric inversions

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A stratosphere is an atmospheric layer where temperature, counterintuitively, increases with altitude. Generated on Earth by the presence of ozone, which absorbs solar ultraviolet radiation and heats the surrounding environment, the stratosphere hosts complex physical and chemical processes impacting the whole atmosphere. Other Solar System planets, such as Jupiter, have a stratosphere, but the detection of this important atmospheric region around exoplanets is very challenging. Tom Evans and colleagues used Hubble Space Telescope spectra and a one-dimensional atmospheric model to unambiguously detect a stratosphere around the exoplanet Wasp-121 b.

Wasp-121 b belongs to the category of ultrahot gas giants, with an equilibrium temperature of $\sim 2,500$ K and revolution period of ~ 1 Earth day. Thus we can expect that the physics and chemistry of its stratosphere are significantly different from the examples in our Solar System. Evans et al. detect spectral emission bands — the signature of a stratosphere — of water vapour and tentatively of gaseous vanadium oxide (exotic for us but expected in such hot planets), and their model predicts a stratospheric temperature increase of $\sim 1,100$ K (compared with ~ 60 K on Earth). Only absorption of stellar radiation by gases and/or high-altitude clouds can provide sufficient heating to generate such a huge increase. The James Webb Space Telescope will provide more precise spectral measurements that will better constrain the composition and the modelling of exoplanetary stratospheres.

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